



# **Armed Forces College of Medicine AFCM**



# THYROID GLAND 2

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# INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture the student will be able to:

1. Classify types and causes of thyroid gland disorders.
2. Interpret the symptoms, signs and laboratory findings in different cases of thyroid dysfunction.
3. Describe goitre and its types.

# Lecture Plan



1. Part 1 (5 min) Introduction
2. Part 2 (35 min) Main lecture
3. Part 3 (5 min) Summary
4. Lecture Quiz (5 min)

# Disturbances of thyroid gland function



It may be either: hypofunction: **hypothyroidism** or hyperfunction: **hyperthyroidism**. In either condition, it is classified into:

**Primary:** if the disease is thyroid in origin.

**Secondary:** if the disease is pituitary in origin.

**Tertiary:** if the disease is hypothalamic in origin.

# HYPOTHYROID



Due to deficient secretion or decreased effects of thyroid hormones. **Causes are:**

## I- Thyroidal:

*a-Congenital:* absence of the thyroid gland or defects in the biosynthesis of thyroid hormones.

*b-Maternally transmitted:* mothers taking antithyroid drugs or excessive iodides depress the thyroid gland of the fetus.

*c- Chronic iodine deficiency:* it is now rare, due to supplementation of table salt with iodides.

# HYPOTHYROID



**d- Iatrogenic:** excessive antithyroid drugs or over remove thyroid tissue surgically, or over destroy thyroid tissue by an overdose of radioactive iodine in cases of hyperthyroidism.

**e- Chronic thyroiditis:** due to destruction of thyroid tissue by viruses or antibodies (autoimmune thyroiditis). (TSH-R[block] Ab, Tg Ab, TPO Ab )

## II- Suprathyroidal :

- Pituitary causes (secondary).
- Hypothalamic causes (tertiary)



### **I- General effects:**

- Decreased calorigenesis, BEE, body temperature & increased susceptibility to cold weather.
- Increased body weight and accumulation of subcutaneous mucoproteins & mucopolysaccharides causing non-pitting edema.
- The skin is coarse & dry.
- Generalized decreased in activity of all body systems: cardiovascular (bradycardia & decreased C.O.), respiratory (brachypnea), gastrointestinal (decreased motility & constipation).



# Symptoms and effects on the body



Unexplained Weight Gain



Menstrual and Fertility Problems

Dry and Flaky Skin



High Cholesterol Levels

<https://www.howtorelief.com/wp-content/uploads/2017/03/Symptom-of-underactive-thyroid.jpg>

Muscle Soreness and Pain



Cold intolerance



Poor Concentration and Memory



## Symptoms and effects on the body



**a- Cretinism: it occurs in children since birth or during early childhood.**

### 1- Special facial features:

Wide nasal bridge, enlarged lips with a protruded tongue and some body characteristics: abdominal bulging with an umbilical hernia & a supraclavicular pad of fat, in addition to a general delay in all developmental criteria.

## Symptoms and effects on the body



- 2- Delayed mentally (Idiot):** the infant is unable to learn in the proper age (IQ is very low) in addition to the inability to sit, to stand, to walk, to speak, to control his urine & stools.
- 3- Delayed physically: (Dwarf)** he is short in height, his fontanel's close & teeth erupt later than normal i.e. the ***milestones of growth are delayed.***
- 4- Delayed sexually:** if he lives to adult age, he is ***sexually infantile: impotent & sterile.***

# Cretinism



<https://mother-top.com/wp-content/uploads/2018/01/Congenital-hypothyroidism-600x373.png>

## Symptoms and effects on the body



***b - Myxodema: the adult patient is characterized by: -***

The patient hates winter and is susceptible to cold.

Mental functions are depressed: he is apathetic & drowsy with a prolonged reaction time.

A special husky voice & absent outer 1/3 of the eye brows.

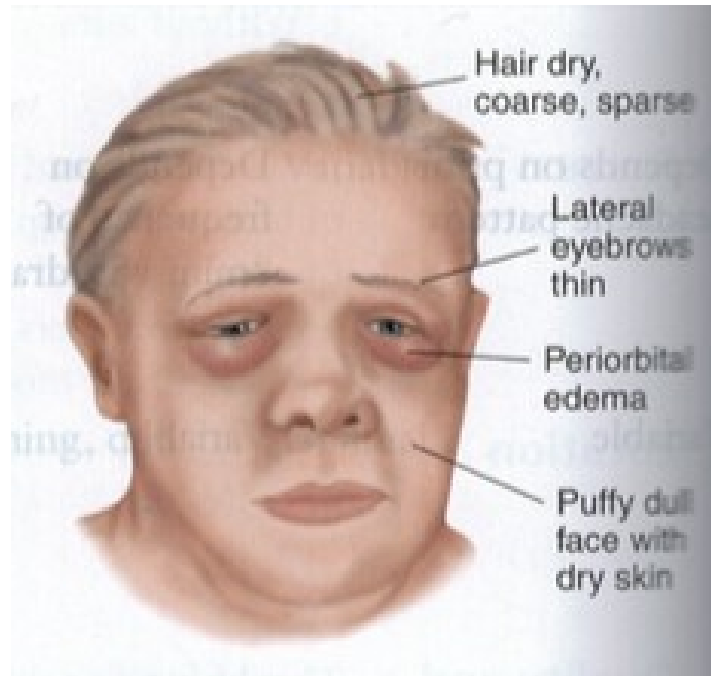
Sexual functions are depressed due to slight atrophy of the gonads.

## Laboratory findings



- o Increased level of cholesterol in plasma.
- o Low T3 & T4 with high TSH in blood (thyroid origin).
- o Low T3 & T4 with low TSH in blood (pituitary or hypothalamic origin).

# Myxoedema



[https://o.quizlet.com/f0p3W6pjPkJErDVQDpKSPw\\_m.png](https://o.quizlet.com/f0p3W6pjPkJErDVQDpKSPw_m.png)



<http://www.dermnetnz.org/assets/manualthumbnails/dermal-infiltrative/img/w/pretibial-myxoedema-22-s.jpg>

# HYPERTHYROIDISM: THYROTOXICOSIS



It occurs in adults. This disease is due to excessive secretion of thyroid hormones. Its causes are:

## ***A- Thyroid overactivity:***

- 1-Acute thyroiditis: irritates the thyroid to secrete excess hormones.
- 2-Tumor or nodules in the thyroid gland secrete excess  $T_3$  &  $T_4$ .

**3-Grave's disease: auto antibodies** against the ***TSH receptors*** of the thyroid cells: ***TSH-R [stim] Ab.*** The TSH receptors stimulated by the antibodies are not



# HYPERTHYROIDISM: THYROTOXICOSIS



## ***B- Suprathyroid overactivity:***

A thyrotrope pituitary tumor.

Resistance of the thyroid receptors in the pituitary (gene mutation). The pituitary secretes TSH unopposed by the normal negative feed back effect of the thyroid hormones.

## ***C - Extrathyroidal activity:***

Ectopic thyroid tissue, produce extra amounts of  $T_3$  &  $T_4$ .

Excessive administration of thyroid hormones by error.

## Symptoms and effects on the body



- 1- Increased BEE (+ 60% to + 100%)** a warm, flushed and sweaty skin. The patient does not tolerate hot weather.
- 2- loss of body weight:** the increased energy gain by the **increased appetite and hyperphagia** is smaller relative to the increased energy loss.
- 3- Increased excitability of the nervous system.** The patient is irritable with nervousness & fine tremors of the extended and abducted fingers, due to increased response of the reticular activating system (RAS) to the circulating catecholamines.

## Symptoms and effects on the body



### 4-Heart rate and CO are increased. *Tachycardia is due to:*

- Direct stimulation of the SAN.
- Thyroxine sensitizes the SAN to catecholamines.
- The increased metabolism leads to increased venous return and reflex tachycardia (**Bainbridge reflex**).

### 5-The systemic arterial blood pressure shows:

A rise in the systolic, due to increased stroke volume & CO.

A drop in the diastolic: due to peripheral vasodilatation.

Increased pulse pressure (increased systolic pressure & decreased diastolic pressure).

## Symptoms and effects on the body



**6-Exophthalmos:** it is the protrusion of the eyeballs; it may be present in some patients. **Cytotoxic autoantibodies** are formed against the **extraocular muscles** and the thyroid gland. These antibodies attack and cause **hypertrophy of the extraocular muscles and the retro-orbital connective tissues** and push the eye ball forward. In late conditions, excessive hypertrophy of these muscles press on the optic nerve and may cause optic atrophy and blindness.

# Symptoms and effects on the body



**exophthalmos**



**INCREASED PALPITATIONS**



**HUNGER**



**irritability**



**GOITER**



**NORMAL THYROID**



**ENLARGED THYROID**



**WEIGHT LOSS**



**muscle weakness**



**HAND TREMORS**



**Heat intolerance**



**Rapid breathing**



<https://www.livealittlelonger.com/wp-content/uploads/2016/11/Symptoms-of-Hyperthyroidism.jpg>





<https://assets.nhs.uk/prod/images/M2700138.2e16d0ba.fill-920x613.jpg>



<http://www.anatomybox.com/wp-content/uploads/2009/08/exophthalmos600a.jpg>

## Laboratory findings



**The thyroid hormones:  $T_3$  and  $T_4$  and the pituitary  $TSH$  may be:**

**High  $T_3$  and  $T_4$  with low  $TSH$ :** in the following cases: thyroiditis hypersecreting thyroid nodules, ectopic thyroid tissue and Grave's disease (Thyroidal & extrathyroidal)

**High  $T_3$  &  $T_4$  with high  $TSH$ :** in the following cases: pituitary thyrotrope tumor, mutation of the thyroid hormone receptors in the anterior pituitary. The mutated receptors are resistant to the normal  $T_3$  &  $T_4$  and so over secrete  $TSH$  (Suprathyroidal).

# Goiter



**Goiter:** is *enlargement of the thyroid gland*. It is used clinically to indicate that an enlarged thyroid is associated with either: normal, decreased or increased thyroid activity.

## ***Types:***

**A -Physiological:** during puberty & pregnancy in females. The thyroid cells and follicles enlarge, to secrete more thyroid hormones, to supply the body with the generalized increased needs in body metabolism.

**B - Hypothyroidism:** the thyroid follicles are full of TG. It occurs in: Iodine deficiency (thyroid hormones are not formed)





**C - Hyperthyroidism:** the thyroid cells increase in size & number.

Thyroid tumor (adenoma).

Autoimmune(**TSH-R[stim] Ab** ) abnormal stimulation  
(Grave's disease)

Secondary stimulation in response to a pituitary tumor.

**D - Nodular goiter:** in the form of multiple enlarged nodules. The thyroid nodules may be hot (active) or cold (inactive).

# Goiter



<http://pharmacology.imedpub.com/articles-images/pharmacology-Simple-goiter-2-3-11-g004.png>



<https://image.slidesharecdn.com/multinodular-160611192110/95/multi-nodular-goitre-mng-11-638.jpg?cb=1465673021>



## Question 1

**A female patient with unexplained weight gain, cold intolerance, and neck swelling, was diagnosed as hypothyroid goitre, which of the following is most likely to match her lab investigations?**

- A- normal T3, T4, and low TSH
- B- low T3, T4 and TSH
- C- high T3, T4 and low TSH
- D- low T3, T4 and high TSH
- E- high T3, T4 and TSH



## Question 2

**Which of the following is right about heart rate in thyrotoxic patients?**

- A- bradycardia due to elevated blood pressure
- B- tachycardia because of antibodies affecting SA node
- C- Tachycardia due to increased sensitivity to catecholamines
- D- bradycardia due to low TSH
- E- tachycardia due to increased catecholamines

## SUGGESTED TEXTBOOKS



1. (Ganong's review of medical physiology) from page 337  
to 349



**Thank you**